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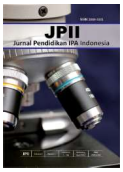

INMPROVEMENT OF TEACHER INQUIRY CAPACITY THROUGH TEACHER TRAINING PROGRAM BASED ON INQUIRY AND SCIENCE TEACHING

C. Ertikanto[1], I. Wahyudi[2], dan Viyanti[3]

[1, 2, 3]Program Studi Pendidikan Fisika, FKIP Universitas Lampung, Indonesia

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ABSTRACT

This research aimed to improve the inquiry and science teaching abilities through inquiry teacher training program. This study used the methods of research and development. Program design began with a training needs analysis, conducted through field studies and literature, then validated and tested on a limited basis for program design. The implemented programs that have been revised in the main try out in KKGSD Bandar Lampung, by using quasi- experimental design, pretest-posttest control group design. Subjects in this study were the elementary school teachers in Bandar Lampung, which involved teachers from primary schools located in the centre of the town, suburb, and remote area. The instruments used were the initial test and final test, questionnaire, assessment of product format, and the observation sheet. The results showed that (1) The inquiry ability of the teacher with PPKIMS through inquiry approach was higher than conventional PPKIMS;(2) The inquiry ability of the teacher to teach with PPKIMS through inquiry approach and conventional PPKIMS after training program was different. There was a significant improvement towards teachers inquiry ability of PPKIMS through inquiry approach, and it was higher than the conventional PPKIMS.

Keywords: inquiry ability training, teaching science through inquiry approach

INTRODUCTION

One of the scientific method to acquire the knowledge that is done in the elementary school (SD) should be by way of a scientific inquiry. As urged by the National Education Standards Agency (BSNP, 2006) that science teaching should be carried out in a scientific inquiry, it is intended to foster the ability to think critically, to establish scientific attitude and to communicate are important aspect of life skills.

Learning science using inquiry method known by the name of inquiry. According to Matson (2006), everything taught by teachers should resemble with the activities done by the scientists. As scientists developed the theory of science or discover the products of science through the activities of scientific research. According to Hofstein et al., 2004, the inquiry allowed students to perform experiments like scientists and give them the opportunity to build knowledge by actually doing scientific work. Therefore, the inquiry is a way of acquiring knowledge with the results of their own business through activities of scientific investigation. Science learning can not be separated from the activities of investigation/inquiry. This statement is in line with Wenning (2005) that described a hierarchy of inquiry-oriented teaching approach as follows: discovery learning, interactive demonstrations, lessons investigations, laboratory investigations, and hypotheticalinvestigations. In this activity, primary school teachers who teach science hereinafter referred to as learners, then trained to develop abilities such inquiry; filed a statement of problems / questions, prepare formula of hypotheses, planning/conduct simple

***Correspondence Address:**
C. Ertikanto
E-mail:

investigations, using mathematics, collecting data to draw conclusions, and report the results of investigations (NRC, 2000; Joyce et. al, 2001; and Karli, 2003).

Elementary Science Learning in Bandar Lampung generally apply the lecture method, the teacher does not involve the student activity like doing experiments, demonstrations, group work and discussion. In addition, the majority of primary school teachers in Bandar Lampung less mastered the concepts of science, and yet fully teach science by the method or approach appropriate learning. By this reality, the research results of Chandra (2010) said that learning science in elementary school of Bandar Lampung did not inquiry the scientific approach but conventionally, a lot of information, is rote, science learning outcomes were low when compared with other lesson.

At the elementary school, science learning in the classroom, the teacher give more cognitive domains only. Learning activities has become fun when the learning science involves the hands-on. The results may have been because of the teacher's weak knowledge about science learning by involving hands-on (Pine et al, 2006). Likewise, according to Ridwan (2005) in his research, many elementary teachers usedconventional learning model, which is a one-way learning process that is dominated by the teacher. Therefore, learning activities was less pleasurable. In the implementation of learning, teachers were simply carry out the task, did not provide meaningful learning experiences for students. This happens because the ability of teachers to teach science was less inquiry.

Research conducted by Budiastara (2008) stated that when teachers plan on learning capability based on science inquiry is good, it can increase the ability of teachers to teach science in elementary school. Furthermore, Khan (2009) provided some excellent examples of thermodynamics based on inquiry-oriented subjects that include hypothetical investigation and can be used as a basis for the development of a lesson.

Luera et al. (2004), in research on the relationship between teachers' knowledge of the inquiry science material with the ability to make a teaching plan based on inquiry learning showed that there was a significant positive relationship between them. Other than that, it was found also that the skills in planning the inquiry learning has contributes significantly to the ability of teachers to teach science. Research of Iyamu & Ottote (2005), suggested that the ability to teach through the use of inquiry to teachers in southern Nigeria, teaching ability was getting better by using inquiry, because when teachers teach the class, the teacher were indirectly also studied. This research was also supported by Baillie & Hazel, 2003; Kilinc 2002 in Arslan (2014) the activities of teachers preparing problems, equipment to be used, the procedures to be followed and the expected answer, or students are required to make these decisions for themselves, develop scale openness to inquiry has been developed to classify laboratory activities more support teachers to continue studying science.

Based on the explanation above, it is necessary to develop the skills of inquiry through training in order to improve the teaching of scientific inquiry for elementary school teachers in the city of Bandar Lampung. Researcher as teacher model of learning were conducted in the form of communication, this is a process how to trade his knowledge (Marx, 20040. If the communication only takes place in one direction "teachers teach and students learn," the instruction learn from teachers will be less, teachers tend to give more lectures, proper instruction and communication between teachers and students was done unproperly (Cuevas et al, 2005). In addition,Kirschner et al (2006) considered that there were evidences from empirical studies have consistently shown that learning was guided minimally less effective and less efficient than learning approach that puts a strong emphasis on the guidance of student learning. While according to Ruiz-Primo & Furtak (2007), they stated that the communication ofscience learning process showing the significant progress by way of scientific inquiry. By this method, the learning process emphasized were asking formulation of the problem/question, drawing up the hypotheses, planning/performing simple investigation using mathematics, collecting data to draw conclusions, and reporting the results of the investigation.

Problems in this study are: (1) How is the ability of teachers before and after the inquiry PPKIMS activities? (2) How is the ability of teachers in the implementation of inquiry teaching science after PPKIMS activities? Based on the formulation of the problems outlined, the research objectives formulated as follows: (1) Describe the inquiry capabilities of teachers before and after PPKIMS; and (2) Describe the inquiry capabilities of teachers in the implementation of teaching Science after PPKIMS activities.

The benefits of this research for the parties concerned were: (1) Providing direct experience of the teachers who are involved in improving the ability of inquiry and learning in primary school

science inquiry. (2) Providing inputs to the principal for the improvement of science teaching at each school; (3) Giving contributions to education department officials of city/country, to improve the ability of teacher inquiry; and (4) As a reference for developers and implementers of training to develop a training model that is innovative, effective and efficient.

METHODS

This study was conducted from April to June of 2015 in the elementary schools of Bandar Lampung city. The sampling technique used was the Quota Sampling (Arikunto & Jabar, 2008), i.e. SD Bandar Lampung which is located in the city center, semi-urban, and peri-urban. From each location, 16 elementary schools were taken as the sample.

The sample in this study were48 teachers in Bandar Lampung who teach grade 4, 5 and 6. In accordance with the draft there were two groups, i.e. the experimental group with the number of 24 teachers, and the control group with the number of 24 teachers. The method of research was pretest-posttes control group design (Arikunto, 2008).

The data obtained were (1) the ability of teacher inquiry before and after activities PPKIMS with pretest-posttest; (2) the performance of teachers in science learning sheet obtained by observation. All data obtained were analyzed with a statistical computer program.

Quality of pretest/posttest instruments were analyzed byanalysis of items which include validity, reliability, distinguishing features and level of difficulty of items, increased knowledge ofteacher inquiry using the normalized scores (Meltzer, 2002). The research data was analyzed by (1) test for normality of data, (2) homogeneity test data, and (3) two different test average.

RESULTS AND DISCUSSION

A. The ability of Teacher's Inquiry

Improvement of the ability of inquiry was indicated in the experimental group with PP-KIMS inquiry compared with the control group with conventional PPKIMS. PPKIMS activities were implemented in the experimental group as well asin the control group. To measure the ability of teacher, it performed a pre-test using the same matter. The average test results are presented in Table 1.

Results of the average pretest, posttest, and N-gain scores in Table 1 were obtained from 24 teachers in the experimental group and 24 teachers in the control group. Recapitulation of inquiry capability test results was analyzed in order to determine the upgrading of teacher inquiry, which is to test the normality, homogeneity, and the average of similarity test. Significance test of the improvement of inquiry between the experimental class and control class was examined by normalized the pretest, posttest, and N-gain. The results of the test are presented in Table 2 below.

The test results in Table 2 shows that the

Table1. Average of Pretest, Posttest, dan N-gainScores

Experimental group	Score			Kelompok Kontrol	Score		
	Pretest	Posttest	*N-gain*		*Pretest*	*Posttest*	*N-gain*
Rata-rata	35.8	84.7	0.8	Rata-rata	41.0	61.5	0.3

Table2. Average Score of Test of Homogeneity andSimilarity

Average	Group	Normality Test[2)]		Homogeneity Test[3)]		Conclusión	Similarity Test Average[4)]		Conclusion *ρ (sig)*
		Stat.	Sig.	Stat.	Sig.		Stat.	Sig.	
Pretest	Experiment	0.153	0.149*)	0.740	0.394	Normalandhomogen	2.218	0.082	Sig. similar[3)] *Sig*=0.082>0.05
	Control	0.122	0.200						
Posttest	Experiment	0.142	0.200	0.003	0.953	Normal andhomogen	12.189	0.000	Sig. different[3)] *Sig*=0.000<0.05
	Control	0.144	0.200						
N-Gain	Experiment	0.154	0.146*)	0.121	0.730	Normalandhomogen	16.196	0.000	Sig. different [3)] *Sig*=0.000<0.05
	Control	0.146	0.200						

*)= Lowest value of significancy
2)= Kolmogorof- Smirnov test (Normal: Sig.> 0,05)
3)= Levene test(Homogen: Sig. > 0,05)
4)= T test (Sig.> 0,05)

Tabel 3. The Difference between Postest Score and Improvement of Teacher's Inquiry in Significance value of $\alpha = 0.05$

Aspects of Inquiry Ability	Average of Score and Gain		A	Conclusion
	Experiment	Control		
Problems issuing	98.6 ±45.8	86.1 ±31.9	0.012	Significant
Hipotheses claiming	86.1 ±51.4	58.3 ±15.2	0.035	Significant
Research planning	58.3 ±34.7	36.1 ±12.5	0.010	Significant
Mathematics application	97.2 ±56.9	79.2 ±29.2	0.003	Significant
Concluding	95.8 ±56.9	69.4±20.8	0.000	Significant
Results communicating	80.6 ±47.2	56.9 ± 8.3	0.005	Significant

pretest to measure the ability of inquiry of the experimental group with the control group was significantly similar (Sig = 0.082> 0.05). The results of posttest showed that there was no similarity between the apparent ability of inquiry classroom teachers in the experiment group with the control class (Sig = 0.000 <0.05). Therefore, the ability of inquiry between experimental group with the control group was significantly different. Based on the N-gain, a similarity was found in the experimental class and the control class (Sig = 0.000 <0.05. This was due to that PPKIMS of inquiry in the experimental group occured in learning situations sequentially and repeatedly with the same concept of inquiry, thus making the teacher to be able to repeat the concept of inquiry well (NRC, 2000).

Other facts show that the ability of inquiry (the pretest) planning/conducting research on two groups of teachers (experimental group and control group) has an equal percentage. After the PPKIMS activities, it showed different results of the average posttest score between the experimental group (58.3% higher) when compared to the control group. The n-gain score of the experimental group reached 0.8 (high category) when compared to the control group that reached 0.3 (medium category). According to Joyce et al (2001), Ruiz-Primo & Furtak (2007), and Hendracipta (2008), in order to formulate the problem, designing a study in science learning requires an understanding of inquiry and a good concept, and gradually exercise and sustainable as did teachers in the experimental group. The result of the similarity of ability of teacher inquiry after PPKIMS was at significance level $\alpha = 0.05$. It appeared that both groups had an average value of posttest which was significantly different in every aspect of inquiry (ρ <0.05), as shown in Table 3.

Based on the results of the analysis of the acquisition and the difference with pretest posttest for teacher inquiry capabilities, when compared between groups of teachers in the experimental class and control class, it turns out there is no similarity between the real inquiry capability classroom teachers experimental group with the control class ($\rho \leq 0.05$). Therefore, the average of posttest value in the experimental class was different when compared to the average value of control group. According to the pretest-posttest results it was indicated that the inquiry PPKIMS was able to improve teacher inquiry PPKIMS compared with conventionalPPKIMS.

B. Description of Teacher's Inquiry Ability to Teach in the Implementation of Science after attending PPKIMS

The ability of teachers to bring out aspects of the inquiry on the implementation of the learning, to analyze the emergence of aspects of inquiry displayed by teachers in learning I and II, were in the form of a statement aspects of inquiry that emerged in the study as determined in the previous researches (NRC, 2000; Joyce, et .al., 2001; Karli, 2003). Based on the results of the analyzed teacher learningrecordings, it acquired the appearance of every aspect of inquiry of 24 teachers. The percentage of the average of every aspects of inquiry on learning I and II are shown in Figure 1.

Based on the graph in Figure 2, it can be explained that the average of percentage of the emergence inquiry aspects in teaching were greatly varies. The average percentage of the lowest was at 10.4% which was the aspect of planning the research and as high as 91.7% in the step of communicating aspects of the research results. No aspect of inquiry that appears to reach an average of 100% in the implementation of sciencelearning. Aspect of research planning was an aspect that showed the lowest average raised by the teacher in the learning of science. The lack of other aspects of the pop-up probably because the teacher did not know clearly what aspects of

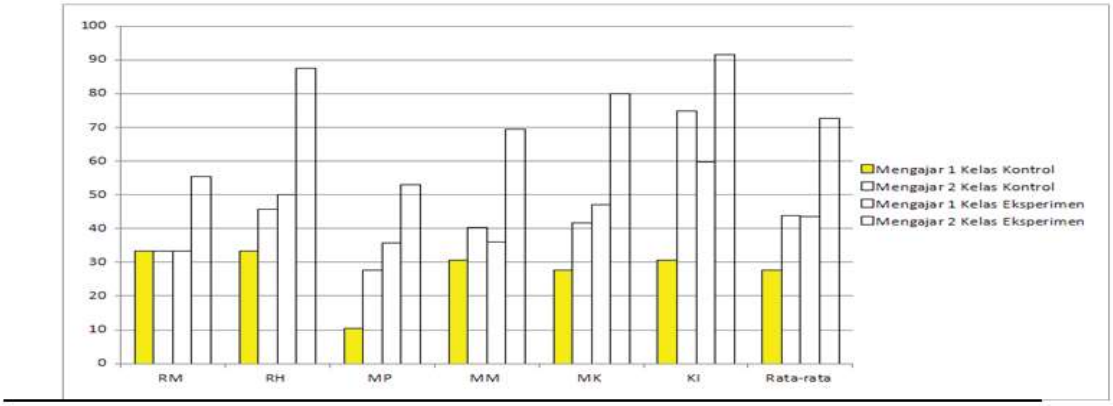

Figure1. The average of percentage of inquiry aspects on the learning activities by teacher in Teaching 1 and 2 between the experimental group with the control group

Keterangan:

RM	= Problems issuing	MM	= Mathematics application
RH	= Hipothesis claiming	MK	= Concluding
MP	= Research planning	KI	= Scientific communication

Table 4. Summary of the Average of N-gain and Score in Learning 1 and 2

Experimental Group	Score			Control Group	Score		
	Learning I	Learning II	*N-gain*		Learning I	Learning II	*N-gain*
Average	41.9	66.6	0.4	Average	25.2	39.6	0.2

the inquiry which should be developed. Therefore, teachers were only able to bring aspects of the inquiry which were generally considered by the teachers at the inquiry learning course. In addition, the presentation of the material factors that were not initially structured and systematic also be the cause of the disappearance of inquiry that being investigated as presented in Table 4.

Recapitulation in Table 4 was obtained from 24 teachers in the experimental group and 24 teachers in the control group. The summary said that there were three teachers on classroom control that maximum in eliciting aspects of inquiry during the implementation of learning II. Moreover, 23 teachers in the experimental class as a whole could bring up aspects of the inquiry, and one teacher that was not maximized in revealing aspects of inquiry. The analysis of the video showed that teachers who have been mentioned above had a maximum in revealing aspects of inquiry, this result is in accordance with the opinion of Hendracipta (2008) which stated that if teachers in implementing the learning meets the systematic and detailed learning steps, it means all activities must be orderly and systematic, clearly from the beginning until the end of learning activities. This statement is in line with Hebrank, 2000: NRC, 2000; Budnitz, 2003; Rustaman and Ridwan, 2004 that revealed that the essence of the teaching of scientific inquiry is the activity to formulate the problem, make a hypothesis formulation, planning/carrying out investigations in a simple, using mathematics to inquiry (counting/classifying), explaining the data to make conclusions, and communicate the results of the investigation measures.

On the results of the analysis of learning I and II were intended to determine the increase in the ability of teachers to teach inquiry between the experimental class and control class by performing normality test, homogeneity, the average of similarity test and N-gain test. For the purposes of upgrading inquiry significance test between the experimental class and control class,it was reached by testing the mean value withnormalized N-gain.The results of tests of normality, homogeneity, and equality test of two averages are presented in Table 5.

As presented in Table 5, it can be remarked that learning I and II were resulted in no simila-

Table5. Normality, Homogeneity, and Similarity Tests between Two Average ofN-Gain of both Experimental and Control Groups

Average	Group	Normality Test[2)]		Homogeneity Test[3)]		Conclusion	Difference Average Test[4)]		Conclusion
		Stat.	Sig.	Stat	Sig.		Stat	Sig	*ρ (sig)*
Learning I	Experiment	0.170	0.073	13.687	0.001	NotNormaland Not homogen	6.852	0.000	Sig. Diff.[4)] Sig=0.000<0.05
	Control	0.230	0.002						
Learning II	Experiment	0.171	0.069	0.028	0.867	Normalandhomogen	11.883	0.000	Sig. Diff.[3)] Sig=0.000<0.05
	Control	0.130	0.200						
N-Gain	Experiment	0.208	0.008	2.550	0.117	NotNormal danhomogen	6.355	0.000	Beda Signifikan[4)]
	Control	0.217	0.005						Sig=0.000<0.05

*)= Lowest values of significancy
2)= Kolmogorof-Smirnov test (Normal: Sig.> 0,05)
3)= T test(Homogen: Sig. > 0,05
4)= Mann-Whitneytest : Sig.> 0,05

rity between the real ability to teach by inquiry in teachers of experimental group with the control group (Sig = 0.000 <0.05). N-gain value also showed that there were similarities on the real ability of the inquiry teaching both in the experimental class and in control class (Sig = 0.000 <0.05). This was due to PPKIMS basis of inquiry in the group of experiments was conducted on sequentially and repeatedly learning situations with the same concept of inquirí. This conditions turned to make the teacher to be able to repeat the concept of inquiry that have been determined before (NRC, 2000; Joyce, et. Al, 2001; Karli 2003) and has been well studied.

CONCLUSION

This research has resulted in products, i.e. PPKIMS in inquirí. It can be deduced as follows: First, the ability of teachers to PPKIMS inquiry by inquiry was increased higher than conventional PPKIMS; Second, the ability of teachers to teach to by inquiry and conventionalPPKIMS-was differentafter the training program, there was a significant increase in the ability of teachers to teach by inquiry PPKIMS. Moreover, the result was higher than the conventional PPKIMS.

Based on the findings in the study of the inquiry PPKIMS development, it can put forward some suggestions as follows: First, each individual teacher should be aware of the necessity of learning. The ability to carry out the task will increase if the teacher always study and explore the knowledge. Second, the researchers (facilitators) who want to apply inquiry PPKIMS should plan well throughout the lesson, e.g syllabi, concept of analysis, SAP, EHS, including the assessment of the performance observation sheet. Third, to overcome the density of the material, it must begin by selection of the essential material that is contextual, relevant to the material closest to everyday life and required in the learning of Science in elementary school. Fourth, the exercise in stages was based on the level of simplicity problems in learning activities, then, the development will gradually increase towards the problems and activities that are more complex; Fifth, the implementation of activities in inquiry PPKIMS takes longer time tan the conventional one. Therefore, the implementation of science learning in the classroom is necessary to manage the time.

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